Food and Agriculture Organization of the United Nations

SUSTAINABILITY BY NUMBERS

Forest products at FAO

SHOUT
SHARE
IT

Required citation:
FAO. 2023. *Sustainability by numbers – Forest products at FAO.* Rome. https://doi.org/10.4060/cc7561en

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

© FAO, 2023

Some rights reserved. This work is made available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; https://creativecommons.org/licenses/by-nc-sa/3.0/igo/legalcode).

Under the terms of this licence, this work may be copied, redistributed and adapted for non-commercial purposes, provided that the work is appropriately cited. In any use of this work, there should be no suggestion that FAO endorses any specific organization, products or services. The use of the FAO logo is not permitted. If the work is adapted, then it must be licensed under the same or equivalent Creative Commons licence. If a translation of this work is created, it must include the following disclaimer along with the required citation: "This translation was not created by the Food and Agriculture Organization of the United Nations (FAO). FAO is not responsible for the content or accuracy of this translation. The original English edition shall be the authoritative edition."

Disputes arising under the licence that cannot be settled amicably will be resolved by mediation and arbitration as described in Article 8 of the licence except as otherwise provided herein. The applicable mediation rules will be the mediation rules of the World Intellectual Property Organization http://www.wipo.int/amc/en/mediation/rules and any arbitration will be conducted in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL).

Third-party materials. Users wishing to reuse material from this work that is attributed to a third party, such as tables, figures or images, are responsible for determining whether permission is needed for that reuse and for obtaining permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

Sales, rights and licensing. FAO information products are available on the FAO website (www.fao.org/publications) and can be purchased through publications-sales@fao.org. Requests for commercial use should be submitted via: www.fao.org/contact-us/licence-request. Queries regarding rights and licensing should be submitted to: copyright@fao.org.

Cover photograph:
Counting the forest's benefits.
©FAO

04
FOUNDATION OF PAST AND FUTURE

07
DOCUMENTING SUPPLY AND DEMAND

15
NAMING FOREST PRODUCTS

23
THE EBB AND FLOW OF FOREST PRODUCTS

31
THE HIDDEN POWER OF WOOD FUEL

35
CARBON STORAGE AND HARVESTED WOOD PRODUCTS

40
PULP PRODUCTION AND PAPER USAGE

46
NEXT FRONTIERS

FOUNDATION OF PAST AND FUTURE

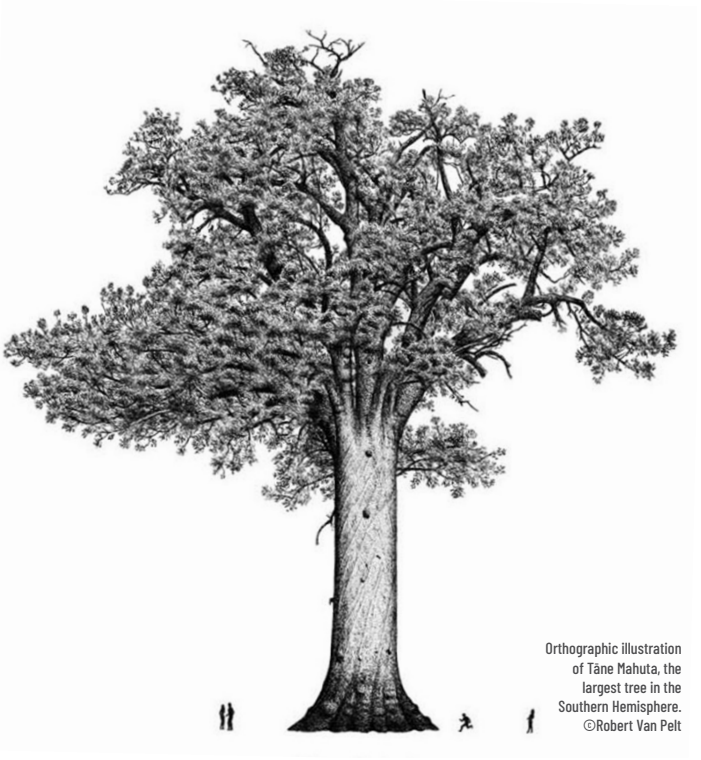
Forests have sustained society and the economy for millennia and will continue to do so.

The silky oak *(Grevillea robusta)*, resistant to wood rot, has long been prized in furniture-making. ©FAO/Luis Tato

TREES OF LIFE

Timber for housing and shelter. Fruit, berries and bark for sustenance and health. Wood for heating and cooking, shipbuilding, and arts and crafts. Without trees, there would be no society as we know it. And the more society advances technologically, the more apparent its innate connection to the forest, and the more evident the related benefits.

Recognizing an unbreakable link to human existence, Indigenous Peoples have long bestowed the "tree of life" honorific on local species of vital significance. In southern Africa, it is the baobab *(Adansonia sp.)*, with its nutrient-packed "superfruit" that ripens even when all else is dry. For the Kakawaka'wakw people of British Columbia, it is the western redcedar *(Thuja plicata)*, with its reliability for roofing and construction. The Hawaiian koa *(Acacia koa)*, now one of the world's most valuable species, and the neem of India *(Azadirachta indica)*, with its antiseptic properties, also bear this distinction. Much traditional wisdom about trees is borne out by modern science. Quinine, extracted from the bark of the cinchona *(Cinchona calisaya)*, has been used to treat malaria, lupus and arthritis. Overall, the United States Forest Service estimates that 40 percent of patent medicines in current use are derived from plants, including the top 20 prescription drugs sold by US chemists.



Orthographic illustration of Tāne Mahuta, the largest tree in the Southern Hemisphere. ©Robert Van Pelt

FOREST PRODUCT DATA: THE ROOTS OF SUSTAINABILITY

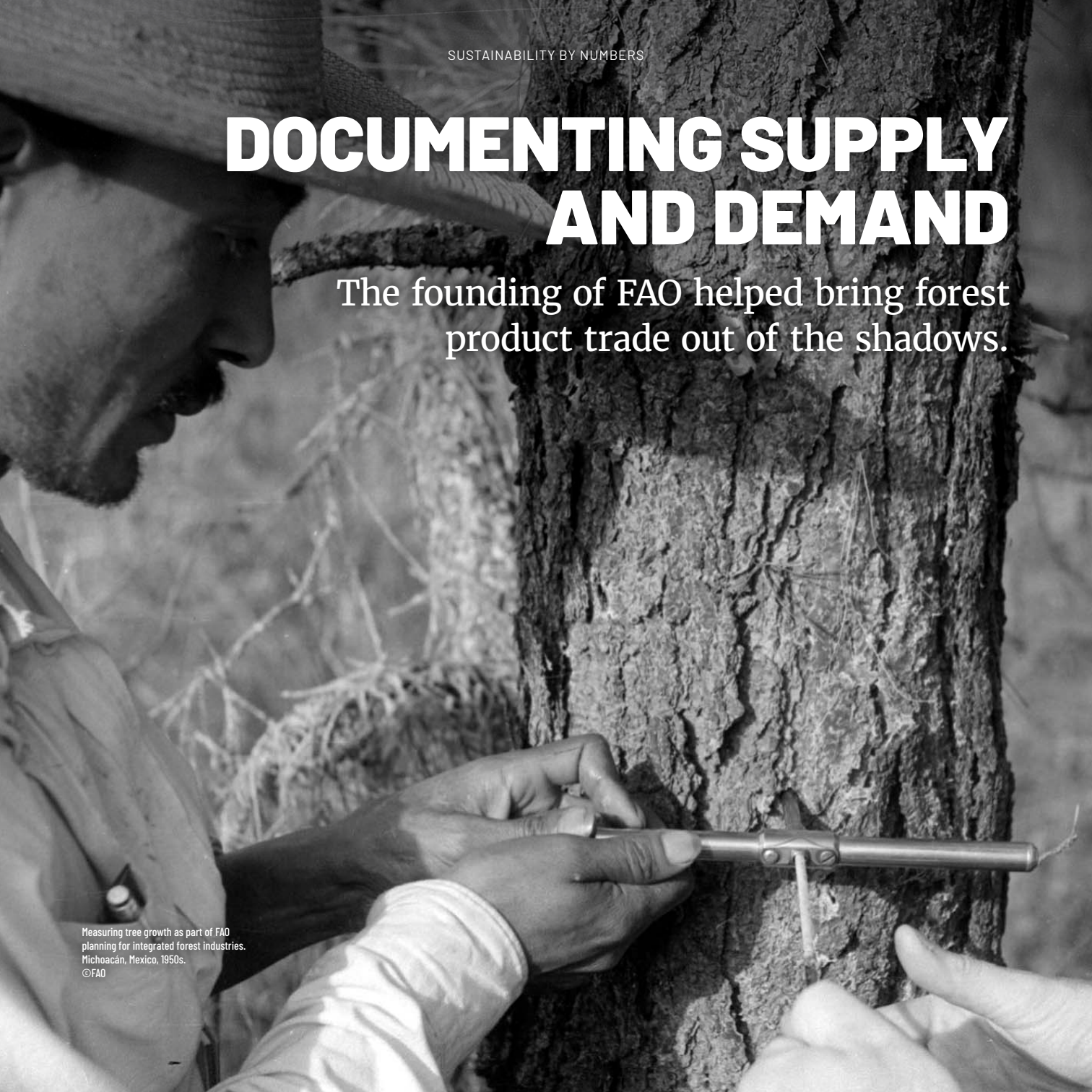
As a changing climate mandates the slashing of carbon emissions, natural solutions such as agroforestry can help feed the planet while sustaining ecosystems. And as researchers delve deeper into the properties that give wood its strength and versatility, new forest products will revolutionize our cities and energy systems. Mass timber will construct wooden skyscrapers. Lignin will power electric vehicles.

More sustainable management of forests and smarter use, consumption and reuse of forest products will contribute to the kind of future that we at FAO express as "the four betters": better production, better nutrition, a better environment and a better life.

This leap will be powered by data. Data reveal where policies are succeeding or need improving. Data may tell us if, where and how the manufacturing of forest products is lifting communities out of poverty and fostering opportunities for trade. Data could help us ascertain that products are sustainably sourced rather than criminally trafficked. In short, better data accelerate progress towards the Sustainable Development Goals (SDGs), humanity's blueprint for a more resilient and equitable future.

DOCUMENTING SUPPLY AND DEMAND

The founding of FAO helped bring forest product trade out of the shadows.



Measuring tree growth as part of FAO planning for integrated forest industries. Michoacán, Mexico, 1950s.
©FAO

Commerce in forest products is as old as civilization. The tomb of Egypt's King Menes (3200–3000 BCE) contained a tablet made of African blackwood *(Dalbergia melanoxylon)*. Archaeological excavation in Rome has revealed oak from northeastern France. Agarwood, used in incense and perfumes, is known to have been traded extensively in the Near East, China, India and Japan.

Ebony plaque found in the tomb of King Menes, believed to have founded Egypt's first dynasty. ©William Matthew Flinders Petrie

Over the centuries, technological improvements in harvesting, milling and transport networks spurred an ever-greater flow of forest products from their leafy origins to cities and towns continents away. In the West and Far East, demand for books and newspapers by a newly literate public drove increased production and trade of pulp, the raw material of paper.

And yet, through it all, there was no overall picture of how states were producing and using forest products. Which and how many forest products were being traded, or who the suppliers and consumers were, would only be known locally – if recorded at all.

As part of the global overhaul of agriculture in the aftermath of the Second World War, a world assessment, complete with underlying data, became imperative. The newly created United Nations Economic Commission for Europe (UNECE) Timber Committee sought to ensure the equitable distribution of sawnwood to rebuild a war-ravaged continent. In 1946, FAO's Forest Product Statistics unit was born.

FAO'S WORK ON FOREST PRODUCT STATISTICS

Over more than three-quarters of a century, the work of FAO's Forest Product Statistics unit has made the Organization the recognized authority for data fundamental to what we now call the global bioeconomy: our increasing economic dependence on biological and renewable resources for livelihoods, energy and consumable items. We provide the numbers that governments and industry need to manage forests and to identify markets and opportunities for new forest products. From its inception, the dedicated unit's assignment was to:

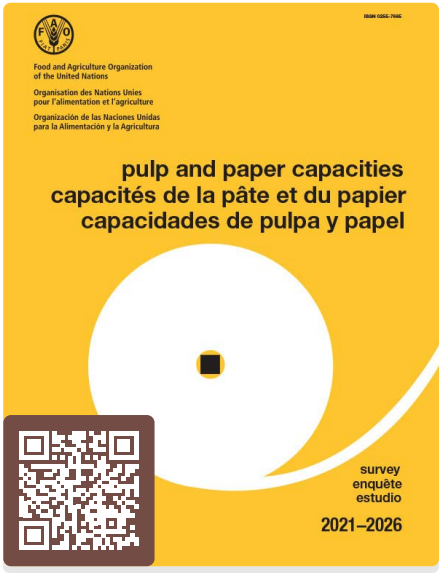
- assess the global rates at which forest products were being produced and their potential productive capacities, and the rates at which they were being used or wasted; and
- publish periodic statements on production, stocks and consumption of forest products and their global trade.

The inaugural *Yearbook of Forest Products Statistics* (now simply FAO Yearbook of Forest Products) saw the day 75 years ago, in 1948. This series remains the most trusted resource on the subject for the general public, policymakers, academics, researchers and industry. And while FAO's specialized unit has become the world's warehouse for global forest product data, the value of collecting forest product statistics has grown. Our statistics are now invaluable for informing sustainable forestry practices; understanding trends in the forest industry and in global trade of forest products; shaping investment decisions; and designing data-driven and evidence-based environmental policy.

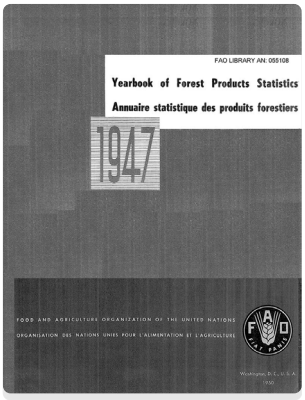
GLOBAL COOPERATION FOR COHERENT DATA

Producing the FAO Yearbook of Forest Products requires intense collaboration. Each spring, four partner organizations – FAO, the United Nations Economic Commission for Europe (UNECE), the Statistical Office of the European Union (Eurostat) and the International Tropical Timber Organization (ITTO) – send Member Nations the Joint Forest Sector Questionnaire. (FAO's Forest Product Statistics unit is currently developing a network of official country correspondents to further improve communication and streamline data submission.) Staff spend the subsequent six months compiling responses, validating data and modelling data where absent. In the autumn, the data are released online; the *Yearbook* is published the following spring. Pairing data on production and trade offers an insight into the economic weight of a given country's forest product sector; it also signals the sustainability of that sector.

A companion to the *FAO Yearbook of Forest Products* is *Pulp and Paper Capacities*, also published annually. Since 1968, the unit has collected detailed statistics on pulp and paper capacity and production. While the Yearbook has the previous year's data, *Pulp and Paper Capacities* is forward-looking – a forecast of where the market might find itself in the coming years.


Food and Agriculture Organization of the United Nations
Organisation des Nations Unies pour l'alimentation et l'agriculture
Organización de las Naciones Unidas para la Alimentación y la Agricultura
pulp and paper capacities
capacités de la pâte et du papier
capacidades de pulpa y papel
survey
enquête
estudio
2021–2026

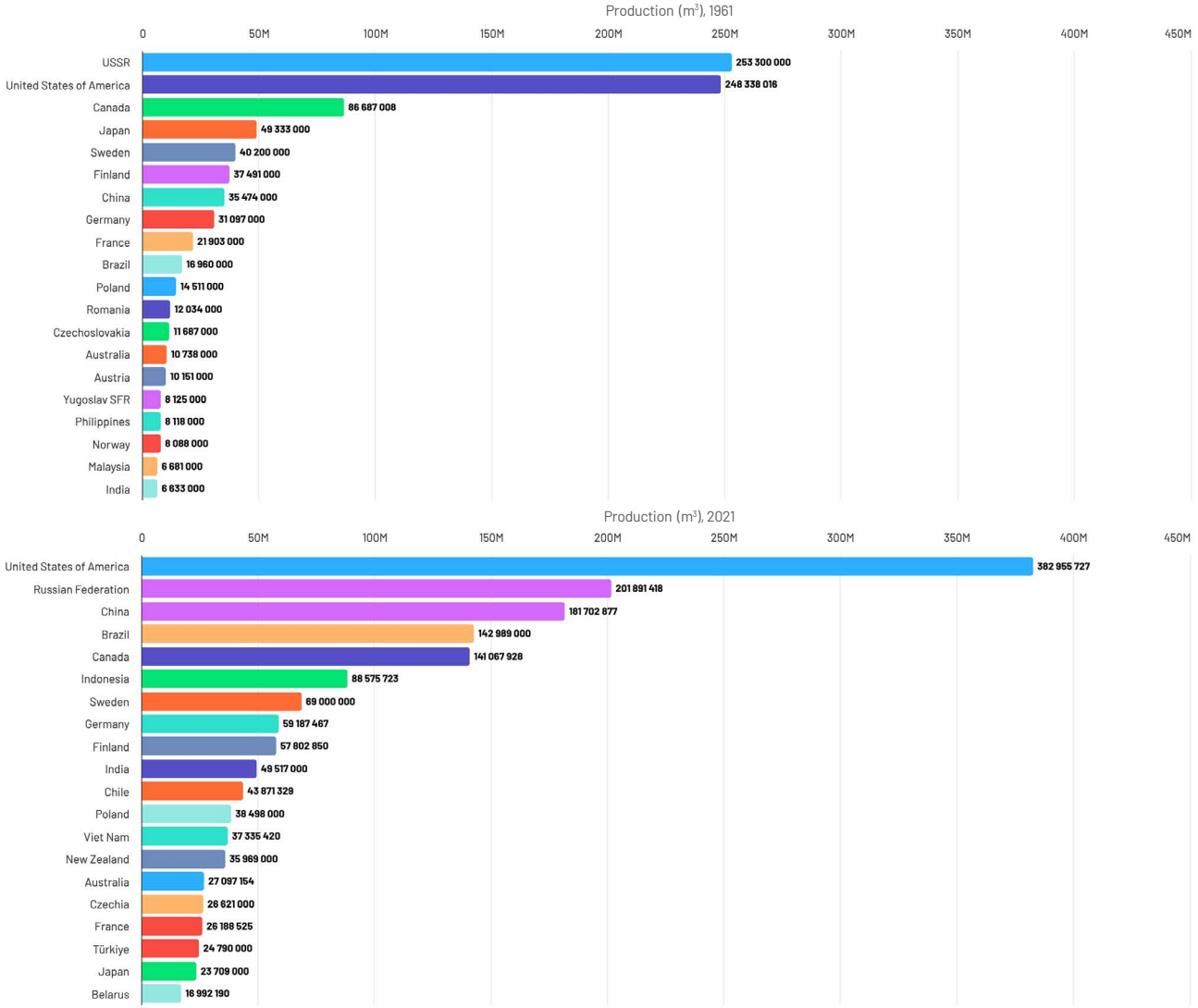
THE *YEARBOOK* THEN AND NOW


FAO LIBRARY AN: 055108
Yearbook of Forest Products Statistics
Annuaire statistique des produits forestiers
1947
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE

- Published in 1948 with data from 1945 to 1946
- 75 countries and territories
- Languages – English and French
- Paper surveys mailed; responses could take months
- Hard copy data booklets mailed on request
- Number of forest products featured – 22

- Published in 2022 with data from 2016 to 2020
- 205 countries and territories
- Languages – Arabic, Chinese, English, French, Russian and Spanish
- Digital questionnaire sent by email
- Online data downloaded every 2 minutes
- Number of forest products featured – 59

INDUSTRIAL ROUNDWOOD PRODUCTION 1961–2021



Data source: FAO. 2023. Forestry production and trade. In: *FAOSTAT*. Rome. Cited 30 June 2023. https://www.fao.org/faostat/en/#data/FO
doi.org/10.4060/CC7561EN-fig01

FOREST PRODUCT DATA: EXPERIENCE, PARTNERSHIPS AND CHANGE

With decades of experience behind it, FAO's Forest Product Statistics unit continues to update and refine the process of data collection and analysis. Every year, the unit validates and updates 200 000 data points. Cross-institutional bodies such as the Inter-Secretariat Working Group on Forest Sector Statistics and the Working Party on Forest Economics and Statistics, as well as country correspondents, coordinate and support this endeavour.

With the globalization of information and advances in technology, dissemination of these free data is even more powerful. What was printed in booklets and mailed around the world is now available in a web-based application linked to parallel FAO agriculture data. This investment in accessibility affords industry, researchers, policymakers and the wider citizenry a comprehensive overview of how the world is producing and consuming the forest products that sustain communities and countries.

> *FAO's workshop was a highly useful exchange – a chance to present our own approach to forest product statistics in Serbia and to become acquainted with accomplishments from other countries in the field. Having experts on statistical sampling and design was of immense benefit.*

Branko D. Glavonjić,
University of Belgrade, Faculty of Forestry

ENABLING BETTER DATA COLLECTION

Collecting, maintaining and reporting forest product data is a significant investment for countries to undertake. Some have an extensive record of it; others are still developing their capacity.

FAO's Forest Product Statistics unit provides training and technical assistance to national statistical organizations and designated agencies. Capacity building is conducted through workshops and conferences, where knowledge, innovation experiences and examples of good practices are shared by both FAO experts and experts from nations with advanced forest product statistical systems.

An integral part of communicating the importance of collecting and reporting forest product data, these workshops are highly valued by correspondents and partners. Surveyed participants in one online workshop co-hosted by FAO and ITTO in October 2021 said the experience illuminated the link between their own country's responses and the accuracy of global totals. Country reporting was understood to be the foundation enabling availability of data "needed to make informed decisions for sustainable management of forest resources".

Capacity building – here in Kunming, China – is part of the mission of the FAO Forest Product Statistics unit, born in 1946. ©Chen Lin

NAMING FOREST PRODUCTS

Product classifications promote transparency and sustainable development.

Timber yard near Rome, Italy.
©FAO/Jeanette Van Acker

When a country exports tropical hardwood, roundwood, cross-laminated timber panels or pulp, that shipment becomes one among millions of data points describing the international trade of forest products. As these data points are compiled in the *FAO Yearbook of Forest Products*, a panoramic picture emerges of where such products are produced and consumed. This compilation is made possible by classifying each forest product – essentially, assigning it a name – through a global classification system.

Food and Agriculture Organization of the United Nations
Classification of forest products 2022
FORESTRY WORKING PAPER
29

THE ORIGIN OF FOREST PRODUCT CLASSIFICATIONS

In 1973, FAO and UNECE first published their *Classification of Forest Products*. It – along with its subsequent editions – lists the names and definitions that are the basis of data collection on wood and paper products around the world. These definitions highlight the characteristics that differentiate one product from another. All parts of the tree except needles and leaves are classified, each of them potential raw material for new forest products.

Classification of Forest Products provides a crosswalk for forest product classifications under the Harmonized System developed and maintained by the World Customs Organization (WCO), the Central Product Classification (CPC) of the United Nations Statistics Division (UNSD) and those of national statistics agencies. For example, FAO classification "041. Wood pellets" equals "Harmonized System 4401.31" and "CPC 39281".

FAO's Forest Product Statistics unit now collects data on 59 product categories. This includes production and trade of primary products such as roundwood, sawnwood, pulp and paper, as well as trade of secondary products including wooden furniture and packaging materials. Staff monitor research reports and industry trends to determine when a forest product rises to the need for classification. They also meet annually with specialists from research institutions and statistics offices to discuss emerging forest products that may require classification.

The Lounge Chair Wood Base (LCW) by Charles and Ray Eames. Moulded plywood revolutionized furniture in the twentieth century.

FAO: A LEADER IN CLASSIFYING FOREST PRODUCTS

In March 2022, the third update of the Classification of Forest Products was published, following collaboration between FAO, UNECE and the UNSD Expert Group on International Statistical Classifications. This revision includes new codes for wood briquettes; sawdust; wood charcoal; laminated veneer lumber; engineered wood products (cross-laminated timber, glulam and I-beams); and wooden furniture. For the first time, these products can be tracked. We can finally, so to speak, see the trees for the forest.

Forest product classifications directly support SDG 9 (Industry, Innovation and Infrastructure), which looks to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. In the nearly 50 years since the publication of the first *Classification*, a paradigm shift has occurred in the product cycle. Where once, in the pursuit to rebuild Europe, roundwood and sawnwood were the primary products being traded and produced, the focus is now on the bioeconomy and products that encourage and support sustainable development and forest management. For example, leftover sawdust from sawmilling is turned into pellets for powering power plants. That, too, needs classifying – and it has been.

CLASSIFICATION AS AN AGENT OF REGULATORY CHANGE

Classification can increase transparency and improve legality of the trade of tropical wood, leading to more sustainable forest management, encapsulated in SDG 15 (Life on Land). The Forest Product Statistics unit has generated codes for tropical wood to track it by origin, which enables better regulated trade and potential detection of overexploited species, as well as an assessment of the risk of tropical deforestation.

As research continues into the use of wood in the manufacture of batteries, clothing and concrete, more classifications are in the pipeline, bringing us ever closer to decarbonizing emissions-intense sectors.

FAO FOREST PRODUCT STATISTICS AND THE LOWER MEKONG REGION

A hotspot of tropical forests and biodiversity, the Lower Mekong Region (LMR) has also become a hotspot of deforestation in recent decades. (The region comprises Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand and Viet Nam.)

After decades of deforestation, the Lower Mekong Region is seeing a push for sustainable timber trade. ©UN-REDD

Wood into furniture in Lao PDR.
©UNDP/Cory Wrigh

Between 1990 and 2015, the LMR lost about 4.7 million hectares of forest to logging, mining and the expansion of agriculture and infrastructure. Countries have struggled to incentivize sustainable wood supply chains and effective forest governance; increasing international demand for wood products and regional trade have fuelled illegal forest exploitation.

Since March 2020, the UN-REDD Programme's Sustainable Forest Trade in the Lower Mekong Region (SFT-LMR) initiative has worked with national governments and regional and local partners in the five countries to combat the trafficking of forest products and to develop systems that ensure legal, sustainable timber trade.

The Transformational Change of Forest Product Value Chains report recommends pathways linked to the activities of and the data collected by FAO's Forest Product Statistics unit. These are:

- Developing internationally competitive forestry enterprises – The FAO Yearbook of Forest Products and the *Pulp and Paper Capacities* report provide a guide to understanding the production of forest products.

- Growing and diversifying export markets for LMR legal and sustainable wood products – These wood products will be assigned an FAO classification upon export. This classification increases transparency for the exporting country and, in turn, the likelihood that countries will import sustainably sourced tropical hardwood.

- Adopting systems to support the transition to legal and sustainable wood resources – FAO's Forest Product Statistics unit provides training that allows countries to develop and enhance their capacity to collect and disseminate forest product data.

Wood into furniture in Lao People's Democratic Republic. ©UNDP/Cory Wrigh

THE EBB AND FLOW OF FOREST PRODUCTS

FAO-produced statistics constitute a chronicle of societal change.

More than nine-tenths of homes built in the United States of America in 2021 were wood-framed.
©FAO/Ashley Steel

Oil and natural gas, with their high carbon footprints, make the news headlines, but timber for housing, pulp for sanitary products, and wood pellets for energy make the present less arduous and the future brighter.

Just as demand for fossil fuels fluctuates in response to economic growth, conflict, consumer demand and manufacturing shifts, so does the demand for, and manufacture of, forest products vary. With datasets spanning decades, FAO's specialized unit can observe global trends that reflect shifts in how society is using forest products, and ultimately in how our collective lives are lived. The data tell a variety of stories.

To track the movement of timber, pulp and wood pellets is to chronicle social change and lifestyle trends

ENERGY

Until the widespread adoption of coal in the 1880s, wood was the primary source of energy for powering machines, heating homes and cooking. The transition to coal signalled a shift to fossil fuels, which continued with the advent of oil and natural gas as a source of energy. But things may be coming full circle, our dependence on coal destined to end. Indeed, while well over 2 billion people still rely on open fires, charcoal and other types of biomass energy for household cooking, the 1970s oil crisis began to establish the much cleaner wood pellets as a commercial fuel alternative: the seeds were sown for a potential return to a wood-fuelled society.

By 2012, wood pellets were assigned their own classification code, no longer lumped together with sawdust, briquettes and fire logs. The move has allowed experts to track the extent to which this renewable source of energy is being generated and traded. We thus see wood pellet production skyrocket in recent years, mainly driven by the demand generated by the European Commission's bioenergy targets: from 2012 to 2021, global output soared nearly 150 percent to 44 million tonnes, increasingly offsetting – though certainly not fully – society's recourse to fossil fuels.

Classifying wood pellets has revealed a huge rise in production, fuelled by new bioenergy targets.

CONSTRUCTION

In 2018, the construction sector alone was responsible for an estimated 40 percent of energy- and process-related greenhouse gas emissions. Using more wood in the sector is a cost-effective way to roll back that percentage.

In the early 1990s, the industry introduced a forest product capable of replacing concrete and steel in certain building applications: cross-laminated timber (CLT). With its crisscrossing layers of sawnwood glued together, CLT panels proved strong and stable enough for office buildings and even skyscrapers. But it was not until a decade ago, as more and more countries embraced the technology, that CLT became an internationally traded product.

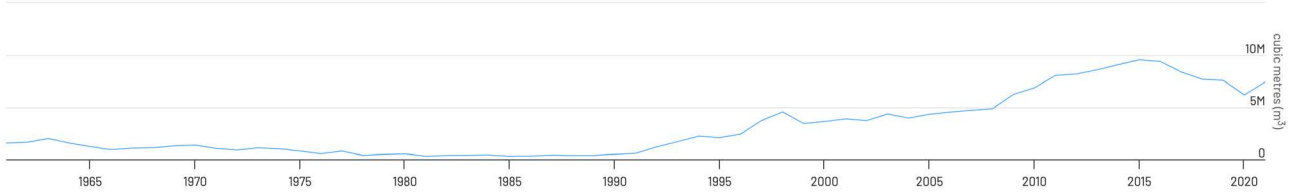
Household counterparts to the CLT panels are particleboard and oriented strand board (OSB), which debuted in the 1960s. Commonly used in construction and furniture manufacturing, OSB first appeared with its own code in the harmonized system nomenclature of the WCO in 2007. In the second half of the 2010s, the global production of particleboard and OSB panels posted the fastest growth among all wood product categories – 25 percent and 13 percent, respectively. Most of the growth in demand for these products came from Eastern Europe, including the Russian Federation.

In 2022, a classification for engineered wood products (CLT, glulam and I-beams) was added to the *Classification of Forest Products*.

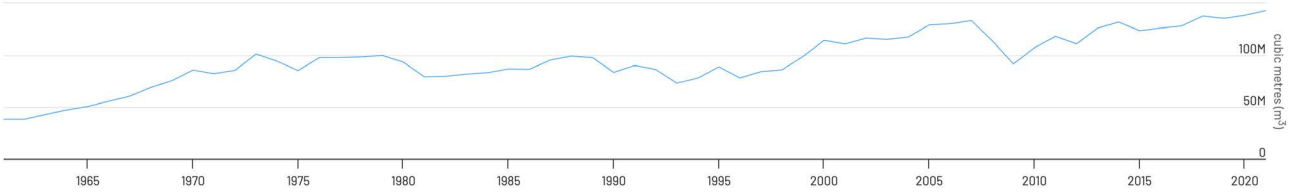
At 85.4 metres, Norway's Mjøstårnet (Lake Mjøsa tower) was the world's tallest wood building at completion in 2019.
©Moelven

FOREST PRODUCT EXPORTS 1961-2021

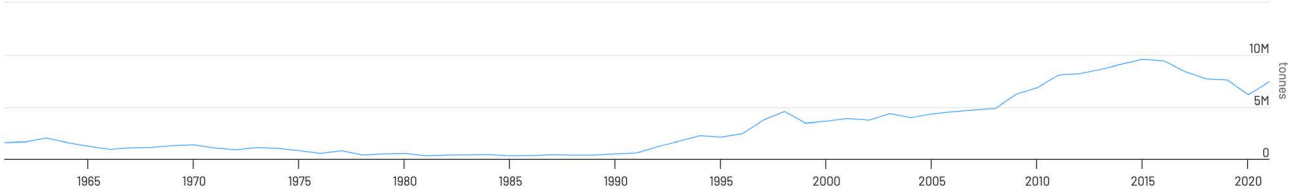
Wood Fuel



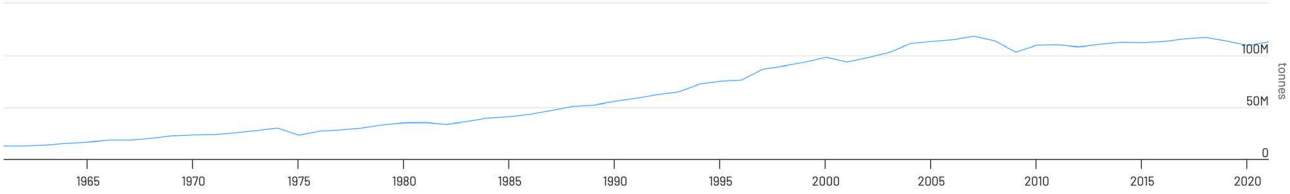
Industrial Roundwood



Wood pulp

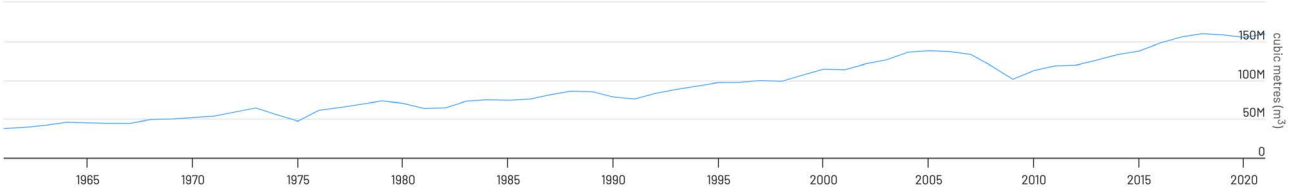


Paper and paperboard

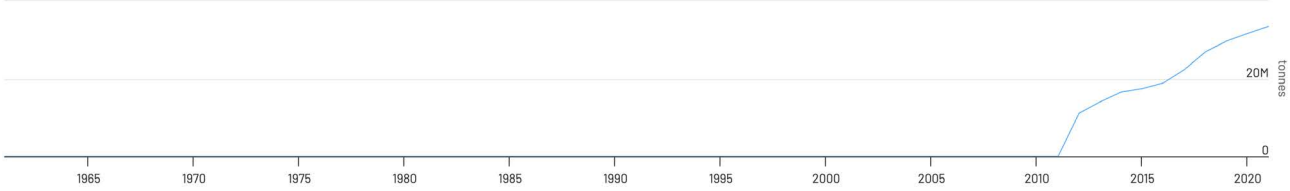


Data source: FAO. 2023. Forestry production and trade. In: *FAOSTAT*. Rome. Cited 30 June 2023. https://www.fao.org/faostat/en/#data/FO
doi.org/10.4060/CC7561EN-fig02

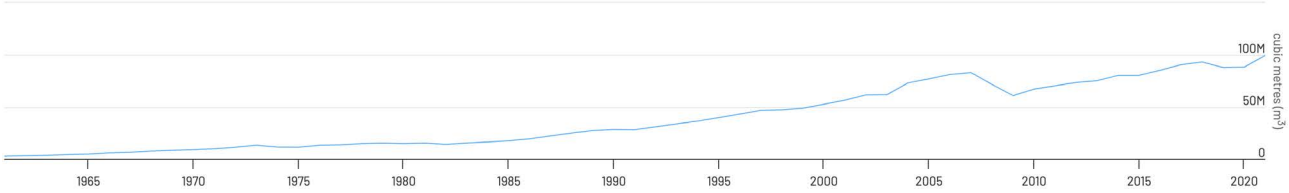
Sawnwood



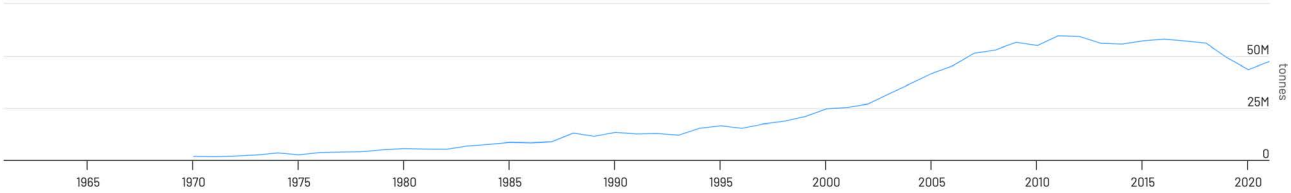
Wood pellets and agglomerates



Wood based panels



Recovered paper



A RECESSION AND A PANDEMIC

Recessions see shifts in consumer spending habits, some less predictable than others. The 2008 crisis caused a sharp drop in the global demand for timber. But not so the 2020 downturn after the COVID-19 pandemic hit, when, far from dampening demand, high prices led the forest products industry to invest in new sawmills.

Similarly, the pandemic saw a surge in the production of packaging paper and paperboard, as well as household and sanitary papers. By the end of 2021, production of items in these categories grew to reach a total of 321 million tonnes – twice as much as thirty years ago.

Conversely, lockdowns accelerated the adoption of digital technologies, and the already declining production of printing paper, writing paper and newsprint plummeted by 11.4 percent. Overall, the contraction over the last 15 years has exceeded 50 percent, down to under 100 million tonnes today.

The COVID-19 pandemic accelerated the decline of printing paper and newsprint, and the surge of packaging and household paper

THE HIDDEN POWER OF WOOD FUEL

The past century and a half of using fossil fuels is an anomaly against the timeline of human history.

Sitting on bundles of cooking fuelwood at Balukhali Refugee Camp in Cox's Bazar, Bangladesh. ©FAO/Sergio Rivero

In our quest for renewable energy, we may yet be returning to a wood-based society

Wood provides more energy than solar, hydroelectric or wind power – an estimated 40 percent of the global renewable energy supply. Tracking it is equally important for monitoring progress towards SDG 7 (Affordable and Clean Energy) and SDG 15 (Life on Land).

FAO and its partner agencies – Eurostat, ITTO and UNECE – annually solicit data from 207 countries and territories on removals of wood from forests for production of fuel, including wood that will be used to produce charcoal. Wood fuel removals can be categorized by source: (i) coniferous, from trees whose leaves do not fall off in the winter, most often found in colder climates; or (ii) non-coniferous, including tropical and non-tropical hardwoods.

CHALLENGES IN QUANTIFYING WOOD USED AS FUEL

The formal data collection process can accurately capture the amount of wood pellets used for industrial energy production and single-family residential heating, as well as the amount of legally harvested trees intended for wood charcoal production. It is less capable of capturing data on informally gathered wood fuel, such as branches collected from the forest adjacent to a village, or illegally produced wood charcoal. These wood energy removals frequently elude registration, leading to a lack of reliable data.

And yet, it is precisely these data that describe the relationship between forests and the world's most vulnerable people. Worldwide, around 2.4 billion people still cook using fuels such as wood and kerosene, mostly in Africa. Illegal or unsustainable wood harvesting for energy production negates progress towards SDG 15, and in particular Target 15.2, which promotes sustainable management and a halt to deforestation.

Nine in ten rural households in Kenya use firewood for cooking and heating.
©FAO/Luis Tato

A new model for estimating wood fuel removals from forests should soon be available.
©FAO/Eddie Gerald

A NEW MODEL FOR COUNTING THE GLOBAL USE OF WOOD FUEL

In 2001, a statistical model was built to estimate wood fuel removals and wood charcoal production. As more information and statistical tools emerged over the following decades, and the ratio of traceable versus hard-to-trace usage became better known, the model needed updating. In 2020, a taskforce was formed to this end, which included partners from academia, non-governmental organizations, and leading international stakeholders.

Updating the model has involved systematically searching for new data points and applying machine-learning approaches for building statistical models. When the new model is released, it will be possible to estimate more accurately how much wood, globally, is removed from forests. We will have a sharper sense of how many people are employed in harvesting and producing wood fuel. We will better understand how much renewable energy comes from wood. And we will be able to calculate how the amount of wood removed annually affects carbon sequestration.

This, however, will not be the end of the road. Improving the capacity to collect data on domestic wood fuel use through household surveys will help us further hone our estimates. We know that wood fuel is, in many ways, the centre of the world: data will enable us to manage this resource now and for the future.

CARBON STORAGE AND HARVESTED WOOD PRODUCTS

Wood not only has a lower carbon footprint than other materials: it is also a “carbon sink”.

Pine tree seedlings at a tree nursery in Mafinga, United Republic of Tanzania.
©FAO/Luis Tato

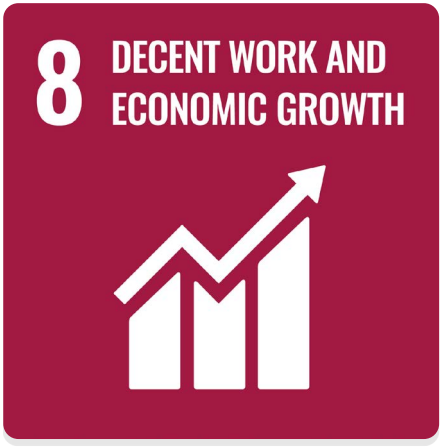
The wood of a tree is composed of millions of carbon molecules, the by-products of photosynthesis. While the tree lives and breathes, it sequesters carbon from the atmosphere, storing it in its trunk and branches. Thanks to this ability to harvest and store carbon, trees are seen as a natural solution to fight climate change.

And while the notion may seem counterintuitive, using harvested wood products can also play a role in slowing climate change. When a tree is harvested, the carbon stays stored in the wood and in the products made from that wood. Seedlings planted to replace the harvested trees can then rapidly begin sequestering new carbon. Tree-planting initiatives such as 75 Trees for UN75 and the Billion Tree Campaign speak to this crucial function.

THE ROLE OF FAO IN QUANTIFYING CARBON STORAGE IN HARVESTED WOOD PRODUCTS

As custodian of the forest product statistics database, FAO has a particular interest in the topic of carbon storage in and the climate change mitigation potential of harvested wood products. Our data can be used to estimate the pool of carbon in harvested wood products including paper, sawnwood and wood panels. Accurate, precise, transparent and complete estimates of carbon storage in forest products, over time and by country, can underpin international agreements on managing greenhouse gas emissions, and help in identifying sustainable development strategies.

Estimating the climate change mitigation potential of harvested wood products serves decision-making and policy design across a range of sectors, from forest management to recycling programmes. It may help incentivize the production of certain products. It can facilitate decisions on whether to ship raw materials abroad for added value, or to build new production facilities at home. Improved capacity to quantify this potential is also apt to boost economic activity associated with the production and sale of sustainably sourced and produced wood products, in line with SDG 8 (Decent Work and Economic Growth) and SDG 15.



FAO's Forest Product Statistics unit supports countries and international organizations through our standardized data solicitation format; by storing and making publicly available the data needed to estimate carbon emissions related to harvested wood products; and through targeted capacity building. The unit has also developed tools to run simulations that assess the potential impacts of policy change on carbon emissions. There is further scope for FAO to expand analysis frameworks by including emerging wood products.

Food and Agriculture Organization of the United Nations
Climate change mitigation and harvested wood products:
Lessons learned from three case studies in Asia and the Pacific
KEY MESSAGES
• Harvested wood products (HWP) from sustainably managed forests can store carbon, increase the availability of biomass for the production of biofuels and substitute for more resource-intensive products.
• Sustainable production of HWPs can contribute to multiple Sustainable Development Goals (SDGs).
• The length of time carbon is stored in HWPs can be increased through re-use and recycling.
• Modeled scenarios suggest that increased re-use and recycling of sawnwood and paper could substantially increase carbon stocks.
• Carbon stocks in HWPs can also be increased through production of longer-lived products.
• Modeled scenarios, using data from India, suggest that, without changing harvest levels, HWPs in India can store an additional 151 million tonnes of carbon (i.e., an increase of 12 percent) if wood use was shifted from wood pulp based products to solid wood products.
• Scenarios run using data from Papua New Guinea suggest a potential increase in carbon stocks of up to 23.1 percent from a 30 percent increase in sustainable production of HWPs.
• Increased data precision can support improved estimates of the carbon stocks in HWPs.
• Computer simulations based on data from Viet Nam confirm the importance of high-quality data to inform effective decision-making.
©Architect Reinhard Madritsch

COUNTING CARBON IN RECYCLED WOOD

Recycled wood is gaining popularity around the world. Beams and floors of centuries-old buildings are being repurposed for new uses, such as furniture, panelling or decorative elements. But counting the carbon stored within recycled materials risks double counting. The question is: In what ways can the carbon in these harvested wood products be counted in their first and in their second use? The answer: We are working on it.

The trade in recycled wood remains underreported.

PULP PRODUCTION AND PAPER USAGE

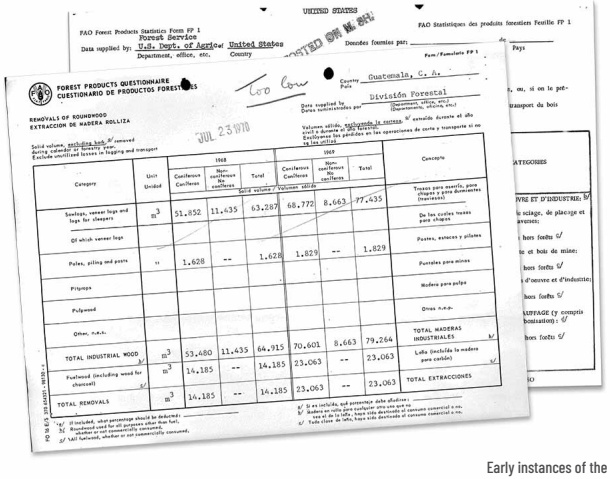
In an increasingly de-materialized world, wood pulp is still everywhere – and finding new uses, all tracked by FAO.

The Bai Bang paper factory, started in 1974, is now one of Viet Nam's most successful enterprises.
©FAO/Joan Manuel Baliellas

Passports. Turpentine. Surgical gowns. These seemingly dissimilar items have one trait in common: they are sourced from trees. More specifically, they are produced from pulp, the cellulose that is extracted from wood.

In 1968, FAO published the first *Pulp and Paper Capacities* report to track and estimate global trends. Data are requested from 32 countries that represent 83 percent of the world's production of paper and pulp. These data cover 30 types of pulp, such as pulp for paper and paperboard; thermo-mechanical coniferous pulp; bleached sulphate pulp; and coniferous dissolving pulp.

Just as the *Yearbook* reflects innovations in wood products, so too does *Pulp and Paper Capacities* reflect innovations in pulp and pulp production. Unlike the *Yearbook*, which is retrospective, *Pulp and Paper Capacities* is forward-looking, allowing industry to direct investment in tree growth and manufacturing facilities.



FAO Forest Products Statistics Form FP 1
Forest Service
Data supplied by: U.S. Dept. of Agriculture, Department, office, etc.
United States
Country
Données fournies par:
Pays

FOREST PRODUCTS QUESTIONNAIRE
CUESTIONARIO DE PRODUCTOS FORESTALES

Country / País: Guatemala, C. A.

REMOVALS OF ROUNDWOOD
EXTRACCION DE MADERA ROLLIZA

JUL 23 1970

Data supplied by / Datos suministrados por: División Forestal

Category	Unit / Unidad	1968 Coniferous / Coníferas	1968 Non-coniferous / No coníferas	1968 Total	1969 Coniferous / Coníferas	1969 Non-coniferous / No coníferas	1969 Total	Concepto
		Solid volume / Volumen sólido						
Sawlogs, veneer logs and logs for sleepers	m^3	51.852	11.435	63.287	68.772	8.663	77.435	Trozos para aserrío, para chapas y para durmientes (traviesas)
Of which veneer logs								De los cuales trozos para chapas
Poles, piling and posts	"	1.628	--	1.628	1.829	--	1.829	Postes, estacas y pilotes
Pitprops								Puntales para minas
Pulpwood								Madera para pulpa
Other, n.e.s.								Otros n.e.p.
TOTAL INDUSTRIAL WOOD	m^3	53.480	11.435	64.915	70.601	8.663	79.264	TOTAL MADERAS INDUSTRIALES
Fuelwood (including wood for charcoal)	m^3	14.185	--	14.185	23.063	--	23.063	Leña (incluída la madera para carbón)
TOTAL REMOVALS	m^3	14.185	--	14.185	23.063	--	23.063	TOTAL EXTRACCIONES

Early instances of the questionnaire that has allowed FAO to produce its *Pulp and Paper Capacities* report since 1968.

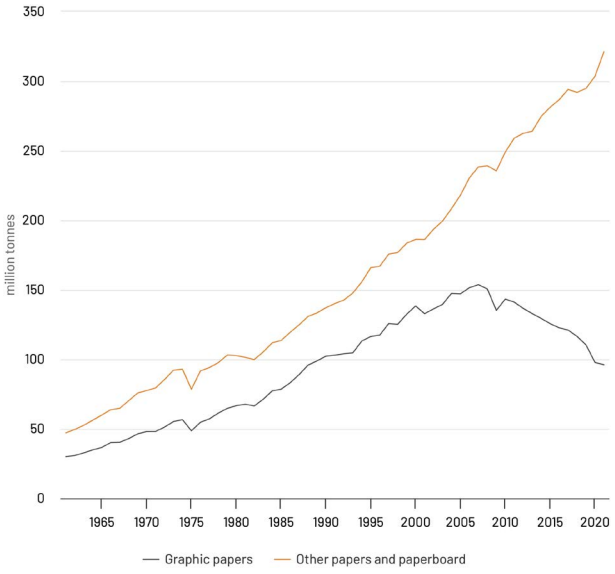
SHIFTS IN PRODUCTION AND DEMAND FOR PULP THROUGH THE YEARS

Trends in the global production and trade of pulp reflect broader economic changes. Prior to the 1990s, North America led the world in the production of wrapping and packaging paper. Now, with much manufacturing shifting east, Asia reports the highest totals of pulp and paper output.

As education levels in a country increase, there tends to be a corresponding rise in the consumption of pulp to produce the paper needed for books and other publications. The use of sanitary products such as tissues or menstrual pads, as well as cardboard for shipping goods, also picks up as countries grow their economies.

In response to the spread of e-commerce since the 2010s, further boosted by COVID-19-related lockdowns, the use of cardboard has expanded dramatically. This correlates with growth in manufacturing capacity: for the first time in decades, the pulp and paper industry is seeing fresh investment.

GLOBAL PRODUCTION OF GRAPHIC PAPERS AND OTHER PAPER AND PAPERBOARD



Data Source: FAO. 2023. Forestry production and trade. In: *FAOSTAT*. Rome. Cited 15 August 2021.
https://www.fao.org/faostat/en/#data/FO
doi.org/10.4060/CC7561EN-fig03

Wood foam tiles and wood foam for packaging.
©Fraunhofer WKI

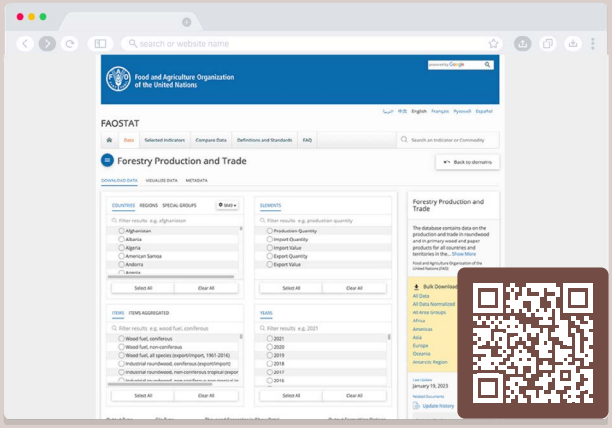
THE FUTURE OF WOOD PULP

Even as more data are generated, collected, communicated and consumed in a digital environment, and the demand for paper and newsprint decreases**,** there is growing demand for other cellulose-based products. Innovation is under way to design products made from wood that can replace those based on fossil fuels. Wood foam, for example, is a lightweight, cellulose-based rigid foam, with low bulk density and high insulating properties. It can be used to create tiles that serve as acoustic or thermal insulation in walls, or to create packaging for materials that require energy or liquid absorption. Although this product is still in development in the laboratory, it will be game-changing once scaled up to mass production.

Cellulose-based products are biodegradable. Even if transitory, they substitute more resource-intensive products and store carbon. By innovating and consuming more cellulose-based products, we can further the goals of improving quality of life while helping mitigate the effects of climate change.

RECYCLED PAPER AND CLIMATE CHANGE

As a cellulose-based product, paper stores carbon. Increased recycling and reuse can lengthen the time that the carbon is stored in the wood fiber. For one sheet of paper, the importance of this change is small; accumulated over reams and reams, it is substantial.

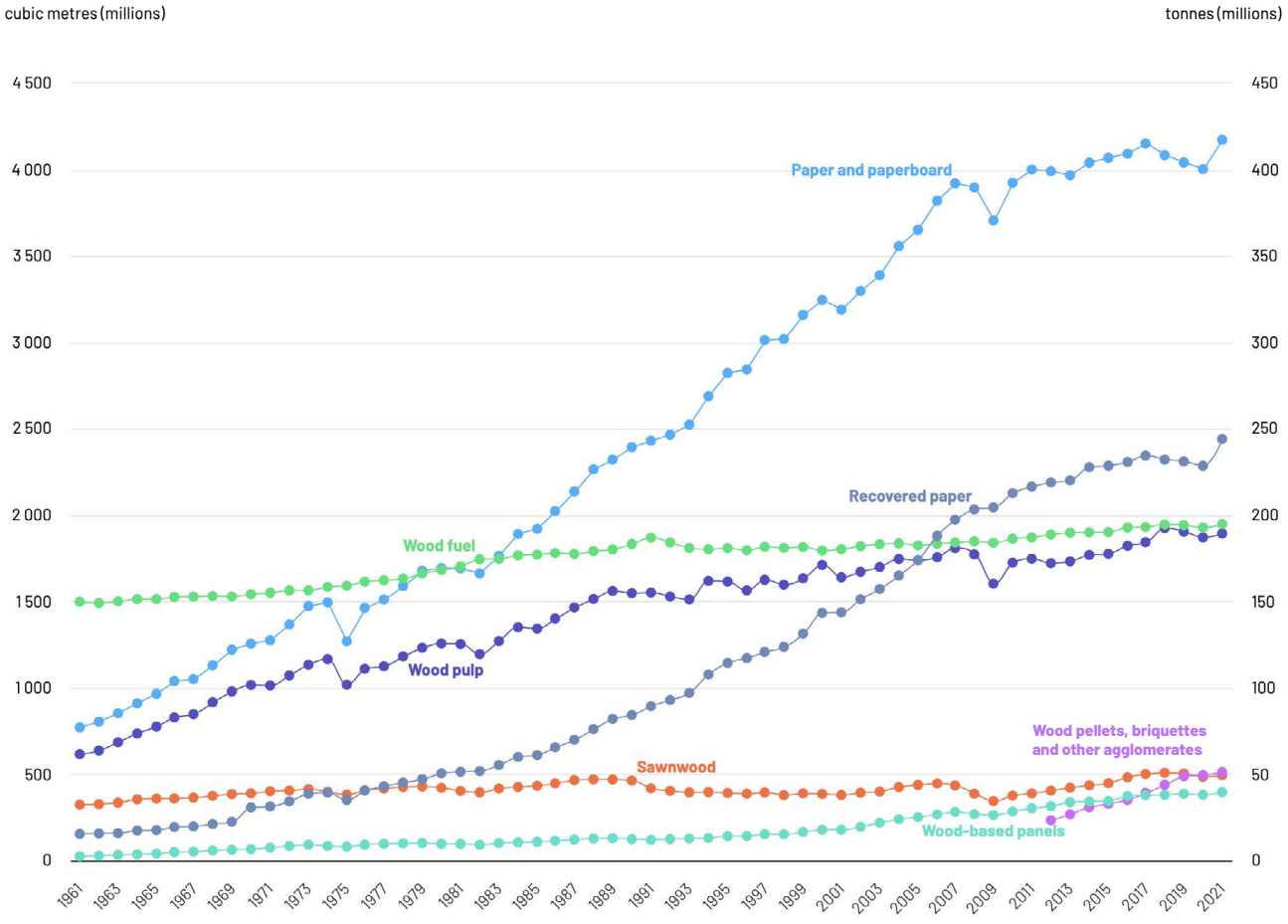


In 1997, the FAO Forest Product Statistics unit began collecting specific data. The Recovered Paper Data report covered 30 countries representing 90 percent of global consumption of recovered paper. In 2018, this report was consolidated into the *Pulp and Paper Capacities* report. Now, an online tool allows the public to track production of post-consumer wood and recovered paper.

In India, the world's most populous nation, only 20 percent of wastepaper is collected; the rest ends up in landfills. Simultaneously, Indian mills have come to rely heavily on imported paper waste, with an import bill that ballooned from USD 5.1 million in 1980 to USD 1.8 billion in 2021.

The FAO Forest Product Statistics unit has also modelled what could happen if the recycling and reuse rate of paper increased in India – specifically, if half of the paper were used for four years instead of two. We estimate in this case that the total stock of carbon in paper in the country could grow by 7 percent to 143.5 million tonnes.

PRODUCTION OF KEY FOREST PRODUCTS OVER TIME



Data source: FAO. 2023. Forestry production and trade. In: *FAOSTAT*. Rome. Cited 30 June 2023. https://www.fao.org/faostat/en/#data/FO
doi.org/10.4060/CC7561EN-fig04

NEXT FRONTIERS

A snapshot of what the future might hold for forest product data

Products such as this cellulose nanofibril computer chip could herald an era of biodegradable electronics.
©Yei Hwan Jung

THE EMERGING BIOECONOMY

Wood-based products can replace those made from fossil fuels, making forests and trees even more significant contributors to the bioeconomy. Packaging, biofuels, construction materials and even microprocessors can now be made from wood.

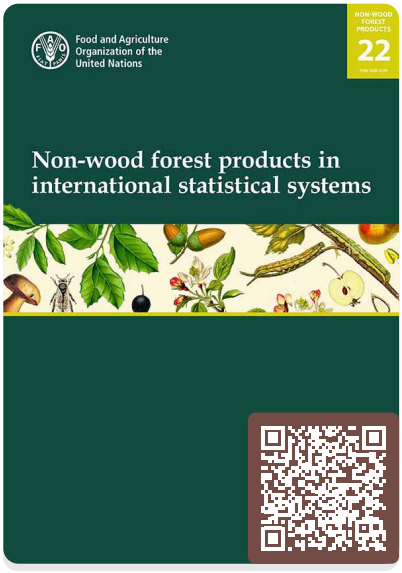
To strengthen the role that forest products play in a circular bioeconomy, there is a need to improve the manufacturing (including eco-design), use, reuse and recycling of forest products, as well as the management of wastewood. The goal is to reduce the environmental impact of each product over its life cycle. As new products appear, and are made and traded in large quantities, more classification codes will be required.

Future-conscious policies, geared to achieving the SDGs and securing their legacy, must look to enable substitution of fossil-derived products with wood-based ones. Developing awareness and addressing knowledge and implementation gaps in the global forest product value chain are crucial in ensuring the sustainability of a forest-based bioeconomy. The FAO Forest Product Statistics unit, with its global dataset and advanced modelling, will continue to catalyse the decisions that drive sustainable forest management.

This Swedish-developed wooden transistor means computing may soon become more sustainable.
©Thor Balkhed/Linköping University

FINDING DATA ON NON-WOOD FOREST PRODUCTS

There is far more to forests and the bioeconomy than wood. Forests are integral to agrifood systems; they are also natural pharmacies. Fruit, mushrooms, nuts, bamboo and cork, as well as wild meat and many freshwater fish species, are among thousands of non-wood forest products used by an estimated 5.7 billion people worldwide. This cornucopia is utilized in myriad ways, from edible foods to the creation of medicines, perfumes, dyes, crafts, clothing and shelter.


Food and Agriculture Organization of the United Nations
NON-WOOD FOREST PRODUCTS
22
Non-wood forest products in international statistical systems

Yet inconsistencies in definitions and non-standard units of measure mean that quantifying the production and trade of these vital goods, especially at the international level, is a complex endeavour. The absence of a consensus on definitions makes it hard to assign classifications. One country may refer to all foods harvested from forests as "Indigenous foods"; another will label them "wild foods". What cannot be standardized is more difficult to capture and compare quantitatively.

Still, information exists for many of these products, and efforts are under way to consolidate it into a global database. A review led by FAO has enabled a refinement of international classifications, culminating in the introduction of ten non-wood forest products (pine nuts, important genera of mushrooms, edible insects and more) into the harmonized system nomenclature of the WCO, and in the production of data profiles for ten highly traded products.

COLLECTING NEW DATA FOR WILD FOREST FOODS

New estimation tools are required to enable countries to collect data on informally gathered non-wood products such as wild forest foods. In partnership with the Centre for International Forestry Research (CIFOR-ICRAF), FAO has been piloting methods for gauging the volume of wild foods gathered in forests by measuring the containers people use to collect these foods and scaling up to national estimates of how much food is carried out of forests and the impact of that food. In terms of nutritional importance, we estimated that in Zambia, for example, the amount of wild fruits consumed from forests would be enough, on average, to meet 25 percent of international recommendations on fruit intake.

In coming years, the FAO Forest Product Statistics unit is committed to identifying additional solutions for collecting such data, so as to capture and communicate the full value that forests provide to our societies.

Wild fruits such as berries play an essential role in human nutrition.
©FAO/Sean Gallagher

INNOVATION IN INFORMATION SYSTEMS

As the world's repository for forest product data, FAO's Forest Product Statistics unit continues to explore the latest innovations in data storage and visualization and to deliver the information that governments and researchers require. This involves automating processes wherever possible. The recent integration of forest product data into FAO's cloud-based statistical working system has streamlined the validation process and enabled full functionality throughout the pandemic-induced lockdowns.

We are experimenting with artificial intelligence (AI) to bring new life to old data. AI can harvest information from historical publications and create downloadable datasets, organized and ready to use.

Recent years have demonstrated the value of FAO's data for answering new questions regarding the role of forest products in mitigating climate change and in providing economic and social benefits to communities. There are even more stories the data can tell. Evolving analyses linking the production and trade of forest products with trends in forest area, urbanization and agricultural production are illuminating opportunities for growth and investment.

Automation and AI will ensure FAO remains the world's go-to forest product data provider

And if the production of microprocessors that incorporate cellulose into their design becomes economically feasible, FAO will have come full circle: our work will be, quite literally, powered by wood.

Orthographic illustration of the Grizzly Giant sequoia in Yosemite National Park, United States of America – reputedly the world's most visited tree.
©Robert Van Pelt

Unless we understand and adequately measure how forest products are made and traded, we cannot build the transparent, dynamic bioeconomy needed for the world to prosper. Forest product data are essential in monitoring impact and innovation in the global wood industry; responding to climate change by calculating carbon emissions; and developing equitable policies that uphold ecosystem services and forest values for our communities. Simply put, forest products – and the data that narrate them – underpin our sustainable future.

ONLINE VERSION

CC7561EN/1/10.23